

KOREAN INTELLECTUAL PROPERTY OFFICE

This is to certify that the following application annexed hereto is a

true copy from the records of the Korean Industrial Property Office.

Application Number: Patent Application No. 10-2003-0002330

Date of Application: January 14, 2003

Applicant(s): LG Electronics Inc.

COMMISIONER

[ABSTRACT OF THE DISCLOSURE]**[ABSTRACT]**

A method of managing a defective area on an optical disc write once which can efficiently replacement-record data, which is recorded in a defect area of the disc such as a BD-WO, in a spare area. During the data reproducing operation, the replacement-recorded data can be normally read out and reproduced instead of a spare area. Also, a temporary defect list information is recorded as a navigation information for the defect area, or repeatedly recorded at least twice in a certain recording region among a lead-in area, data area, and lead-out area, so that the stability of temporary defect list information can be secured.

[TYPICAL DRAWING]

FIG. 3.

[INDEX WORDS]

blu-ray disc write once(BD-WO), defect area, temporary defect list(TDFL), temporary disc definition structure(TDDS), repeatedly recording

[SPECIFICATION]

[TITLE OF THE INVENTION]

METHOD OF MANAGING A DEFECTIVE AREA ON AN OPTICAL DISC
WRITE ONCE

5 **[BRIEF DESCRIPTION OF THE DRAWINGS]**

FIG. 1 schematically illustrates the construction of a general optical disc
recording/reproducing apparatus;

FIG. 2 illustrates a method of managing a defect area on a general rewritable BD-
RW;

10 FIG. 3 illustrates a method of managing a defect area on a blu-ray disc write once
according to a first embodiment of the present invention;

FIG. 4 illustrates navigation information created and recorded by the method of
managing a defect area on a blu-ray disc write once according to the present invention;

FIG. 5 illustrates a method of managing a defect area on a blu-ray disc write once
15 according to a second embodiment of the present invention; and,

FIG. 6 illustrates a method of managing a defect area on a blu-ray disc write once
according to a third embodiment of the present invention.

Reference numerals of the essential parts in the drawings

10 : optical disc	11 : optical pickup
20 12 : VDR system	13 : encoder

[DETAILED DESCRIPTION OF THE INVENTION]**[OBJECT OF THE INVENTION]****[FIELD OF THE INVENTION AND DISCUSSION OF THE RELATED ART]**

The present invention relates to a method for managing a defective area on an
5 optical disc of writable once type, such as a Blu-ray Disc Writable Once (BD-WO).

Recently, it is expected that a new type of high density optical disc, on which a
high quality video, and audio data can be written for a long time, such as a Blu-ray Disc
rewritable (BD-RW), is developed and put into practical use.

In the meantime, referring to FIG. 1, an optical disc device for writing/
10 reproducing a data on/from the BD-RW is provided with an optical pickup 11 for
writing/reproducing a signal on/from an optical disc 10, a Video Disc Recorder (VDR)
system 12 for processing a signal from the optical pickup 11 as a reproduced signal, or
demodulating and processing an external data stream into a writable signal suitable for
writing, and an encoder 13 for encoding, and providing an external analog signal to the
15 VDR system.

Referring to FIG. 2, the BD-RW is divided into, and assigned as a Lead-In Area
(LIA), a data area, and Lead-Out area (LOA), with an Inner Spare Area (ISA) and an
Outer Spare Area (OSA) assigned to a fore end and a rear end of the data area.

According to this, the VDR system 12 of the optical disc device writes the
20 external data in clusters corresponding to an ECC Block unit having a predetermined

size of recording after encoding and demodulating the external signal into a signal suitable for writing, when, as shown in FIG. 2, if there is a defective area in the data area found in the middle of writing the data, the VDR system 12 carries out a series of replacement writing operation in which the clusters of data written on the defective area is written on one of the spare areas, for an example, on the inner spare area (ISA) in place of the defective area.

Therefore, even if there is a defective area in the data area of the BD-RW, the VDR system 12 can prevent a data writing error in advance by, after writing the clusters of data written on the defective area on the spare area in place of the defective area, and reading, and reproducing the data from the spare area.

However, since a method for an effective management of a defective area on the BD-WO, of which standardization is under discussion currently, is not provided yet, a solution of which is required, urgently.

[TECHNICAL TASKS TO BE ACHIEVED BY THE INVENTION]

Accordingly, the present invention is directed to a method for managing a defective area on an optical disc of writable once type that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention designed to solve the foregoing problem lies on providing a method for managing a defective area on an optical disc of writable once type, in which a data written on a defective area of an optical disc, such as a BD-WO, is

written and managed effectively by writing the data on other data area or a spare area in place of the defective area.

[PREFERRED EMBODIMENTS OF THE INVENTION]

To achieve these objects and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, the method for managing a defective area on an optical disc of writable once type, includes a first step for detecting existence of the defective area within a writing sector after writing a data in the writing sector in a data writing operation, a second step to replacement-record the data, which is written in the defective area of the disc, in a spare area dividedly arranged in the data area; and a third step for writing a navigation information on the defective area as a temporary defect list information in a specified recording region dividedly arranged in advance.

In another aspect of the present invention, the method for managing a defective area on an optical disc of writable once type, further includes a first step of dividedly arranging a spare area, for replacement-recording data of a defect area which exists in the data area, in the optical disc on which a lead-in area and a data area are dividedly arranged, and a second step of repeatedly recording at least twice a temporary defect list information of the defect area in a specified recording region previous to or within the data area.

Reference will now be made in detail to the preferred embodiments of the

present invention, examples of which are illustrated in the accompanying drawings.

FIG. 3 illustrates a diagram of a method for managing a defective area on a BD-WO in accordance with a first preferred embodiment of the present invention, wherein, for example, the Blu-ray Disc Write Once (BD-WO) includes an Lead-In Area (LIA), a data
5 area, and an Lead-Out Area (LOA). The data area may be divided into a user data area where a Physical Sector Number (PSN) and a Logical Sector Number (LSN) are simultaneously given and a non-user data area where only the PSN is given.

The non-user data area, as shown in FIG. 3, is divided into an Outer Spare Area (OSA) for replacement-recording data of a defect area and a Temporal Defect List Area
10 (TDFL) for recording the navigation information of the defect area and the replacement-recorded data.

Also, the OSA could be replaced with an inner space area (ISA) which is in the head of the recording region of the data area, or an additional ISA may be arranged in the data area. Or else, the TDFL could be, as same as the ISA, replacement-recorded or
15 additionally arranged in the data area adjacent to the OSA, or additionally arranged in the LIS.

In the meantime, the VDR system 12 of the optical disc device described with reference to FIG. 1 writes data continuously on a predetermined writing sector in the user data area in writing a data, wherein the predetermined data writing sector may be
20 set as a Defect Verify Unit (DVU) of a recording size equivalent to one or more than

one physical track or cluster for detecting the defective area during data writing.

Then, after writing the data on the DVU, the VDR system 12 repeats a series of defective area detecting operation, in which the VDR system 12 reproduces the data written in the DVU, and verifies the data of being written regularly.

5 For an example, as shown in FIG. 3, after writing a first to a fifth clusters #1 ~ #5 continuously as a first defect verify unit DVU #1 (S10), the VDR system 12 reproduces the data written on the DVU #1 progressively, and detects defective area. In the meantime, if a defective area is detected in the cluster #2 (S11), the VDR system 12 performs the recording operation for replacement-recording the data of cluster #2, for
10 example, the data of the cluster #2 temporarily stored in an internal buffer (not illustrated) of the VDR system, in the OSA (step S12).

At this time, the data of the cluster # 2 may be replacement-recorded from the tail of the OSA or from the head thereof. The VDR system 12, after the replacement recording operation as described above, reproduces again the data recorded in the
15 cluster # 3 of the first DVU, and if the defect area is detected in the cluster # 4 (step S13) at this time, the VDR system performs the recording operation for replacement-recording the data of the cluster # 4, for example, the data of the cluster # 4 temporarily stored in the internal buffer of the VDR system, in the OSA (step S14).

Eventually, the DVU #1 becomes to have clusters #1, #3, and #5 written
20 thereon regularly, and two defective areas, and the clusters #2 and #4 replacement

written thereon in place of the defective area.

In the meantime, when a data recording having a temporal continuity (recording 1) ends while above defective area detection and replacement writing operation is continued in the DVU #1, DVU #2, -----, DVU #n repeatedly, the VDR system 12 writes navigation information as TDFL, for managing the data written in the defect area 5 and the replacement-record data, at least twice, so as to obtain the security of the TDFL information.

For example, as shown in FIG. 3, the VDR system 12 records the TDFL in a temporary defect management area (TDMA) dividedly arranged in the LIA as main 10 TDFL (*Main_TDFL*) information, and repeatedly record the TDFL information in the TDFL area arranged in the head of the recording region of the data area as sub TDFL (*Sub_TDFL*) information as well.

At this time, the repeatedly recorded main and sub TDFL information, as shown in FIG. 4, includes a plurality of defect entries (*Defect_Entry #1~#m*), and in each defect 15 entry, a physical sector number of the defect area *PSN of Defective* and a physical sector number where the corresponding data is replacement-recorded *PSN of Replacement* may be recorded in association with each other.

Meanwhile, the VDR system 12 records information for rapidly accessing the repeatedly recorded main and sub TDFL information. For example, the temporal disc 20 definition structure (TDDS) information, in the TDMA separately arranged in the lead-

in area.

For example, the TDDS information, as shown in FIG. 4, includes the physical sector numbers *PSN of M_TDFL # 1* and *PSN of S_TDFL # 1*, for indicating the first TDFL *TDFL #1* each being included in the main TDFL *Main_TDFL* information or the
5 sub TDFL *Sub_TDFL* information, respectively.

Also, if a user requests a disc finalization for finally terminating the data recording on the optical disc, a series of operations for copying and recording the TDDS and main TDFL information, which are stored in the TDMA, in the DMA separately arranged in the lead-in area.

10 Thus, if a defect is included in the main TDFL information recorded in the BD-WO, the VDR system 12 can search the repeatedly recorded sub TDFL instead, and thus improve the security of the TDFL information.

Meanwhile, the TDFL information is recorded twice or more as described above. That is, as shown in FIG. 5, the TDFL information can be dividedly recorded in the
15 lead-in area, which is the recording region preceding the data area, and the recording region following the data area two times or more. Also, the TDFL information, as shown in FIG. 6, may be dividedly recorded in the head or the tail of the data area two times or more, or sequentially recorded therein.

For reference, the TDFL information repeatedly recorded at least twice according
20 to the present invention may be dividedly recorded in another recording region in

addition to the specified recording region described with reference to FIGs. 3 to 6, for example, in a partial recording region of the outer spare area or in the lead-out area. Also, the TDDS information may be repeatedly recorded at least twice to secure the stability of the information.

5 It will be apparent to those skilled in the art than various modifications and variations can be made in the present invention. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

[EFFECT OF THE INVENTION]

10 As described above, the present invention provides with a method of managing a defective area on an optical disc write once which can efficiently replacement-record data, which is recorded in a defect area of the disc such as a BD-WO, in a spare area, wherein, during the data reproducing operation, the replacement-recorded data can be normally read out and reproduced instead of a spare area. Also, a temporary defect list
15 information is recorded as a navigation information for the defect area, or repeatedly recorded at least twice in a certain recording region among a lead-in area, data area, and lead-out area, so that the stability of temporary defect list information can be secured.

What Is Claimed Is:

1. A method of managing a defect area on an optical disc write once including a temporal defect management area and a plurality of record layers for managing the defect area by recording temporal defect area information and temporal defect list information on the temporal defect list area, the method comprising:

a first step of recording and managing the temporal defect area information on the defect area in a generation order; and

a second step of dividedly arranging the temporal defect list information on the plurality of record layers, by each.

2. The method as claimed in claim 1, wherein the temporal defect list information is recorded on the plurality of record layers, and managed as a unit.

3. The method as claimed in claims 1 or 2, wherein the plurality of record layers is formed in two layers.

4. The method as claimed in claim 3, wherein the temporal defect list information is recorded by one in each record layer, which enables to record two clusters at once whenever writing the information.

5. The method as claimed in claim 1, wherein the temporal defect list information includes positional information on the defective area.

5 6. The method as claimed in claim 1, wherein the temporal defect list information includes status information for identifying the status of the information recorded on the record layer.

7. The method as claimed in claim 6, wherein the status information is track
10 information for the relevant record layer.

8. The method as claimed in claim 6, wherein the status information is record completion indication information, by a record unit, for the relevant record layer.

15 9. The method as claimed in claim 1, wherein the temporal defect list information is recorded by including the temporal defect area information recorded in advance.

10. A method of managing a defect area on an optical disc write once including a
20 temporal defect management area and a plurality of record layers for managing the

defect area by recording temporal defect area information and temporal defect list information on the temporal defect list area, the method comprising:

a first step for detecting existence of the defective area within a writing sector;

and

5 a second step of recording the temporal defect list information in accordance with the generation order of the defect area, the temporal defect list information being recorded on every of the plurality of record layers by dividedly arranging the same.

11. A method of managing a defect area on an optical disc write once including a
10 temporal defect management area and a plurality of record layers for managing the defect area by recording temporal defect area information and temporal defect list information on the temporal defect list area, the method comprising:

a step of dividedly arranging the temporal defect area information and the temporal defect list information on every of the plurality of record layers, for managing
15 the information on the record layer.

12. The method as claimed in claim 11, wherein the temporal defect list information includes positional information indicating the newest temporal defect area information.

13. The method as claimed in claim 11, wherein the temporal defect list information includes status information for identifying the status of the information recorded on the record layer.

5 14. The method as claimed in claim 13, wherein the status information is track information for the relevant record layer.

15 15. The method as claimed in claim 13, wherein the status information is record completion indication information, by a record unit, for the relevant record layer.

10

16. The method as claimed in claim 11, wherein the temporal defect list information dividedly arranged on each record layer is recorded by including positional information indicating the newest position of the temporal defect list information.

15 17. The method as claimed in claim 11, wherein the temporal defect area information is recorded by including the temporal defect area information written before, cumulatively.

18. A method of managing a defect area on an optical disc write once including a
20 temporal defect management area and a plurality of record layers for managing the

defect area by recording temporal defect area information and temporal defect list information on the temporal defect list area, the method comprising:

a first step for detecting existence of the defective area and the record layer; and

a second step for dividedly arranging the temporal defect area information and

5 the temporal defect list information on each record layer.

19. A method of managing a defect area on an optical disc write once comprising steps of forming a temporal defect management area in a specified area of the disc having a plurality of record layers, forming an area for recording a temporal defect area
10 information and a temporal defect list information, and recording the temporal defect list information in the plurality of record layers by dividedly arranging the same.



DRAWINGS

FIG. 1

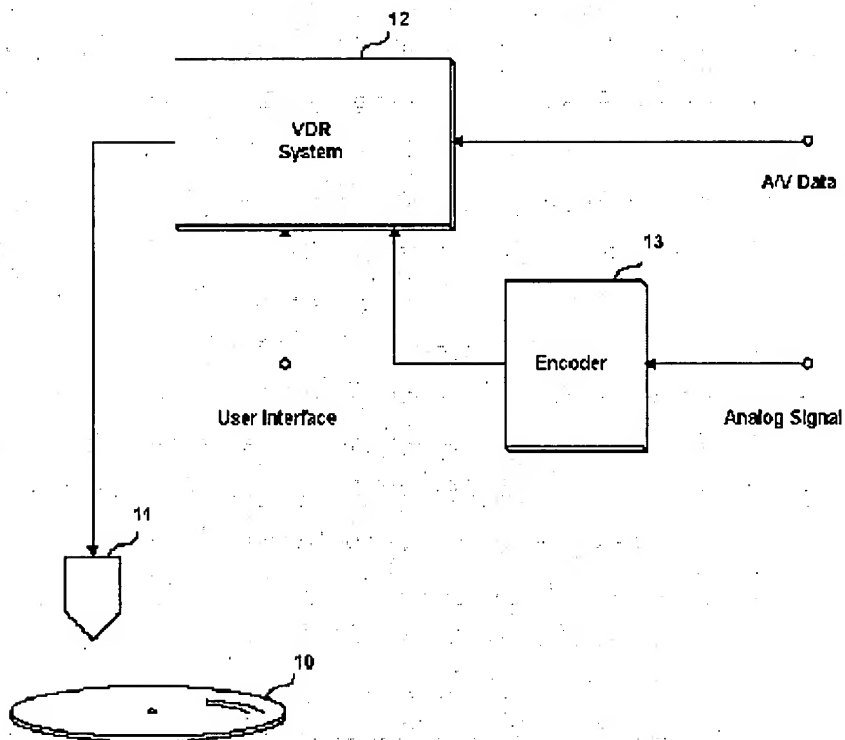


FIG. 2

BD-RE

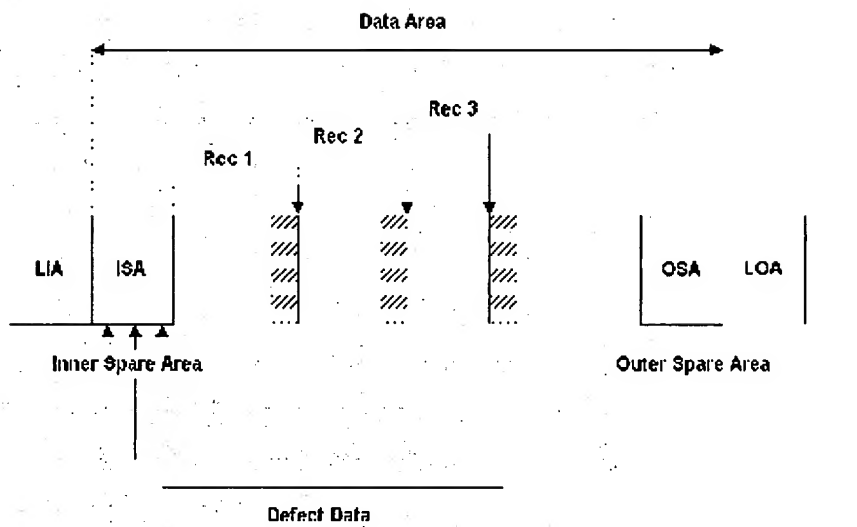
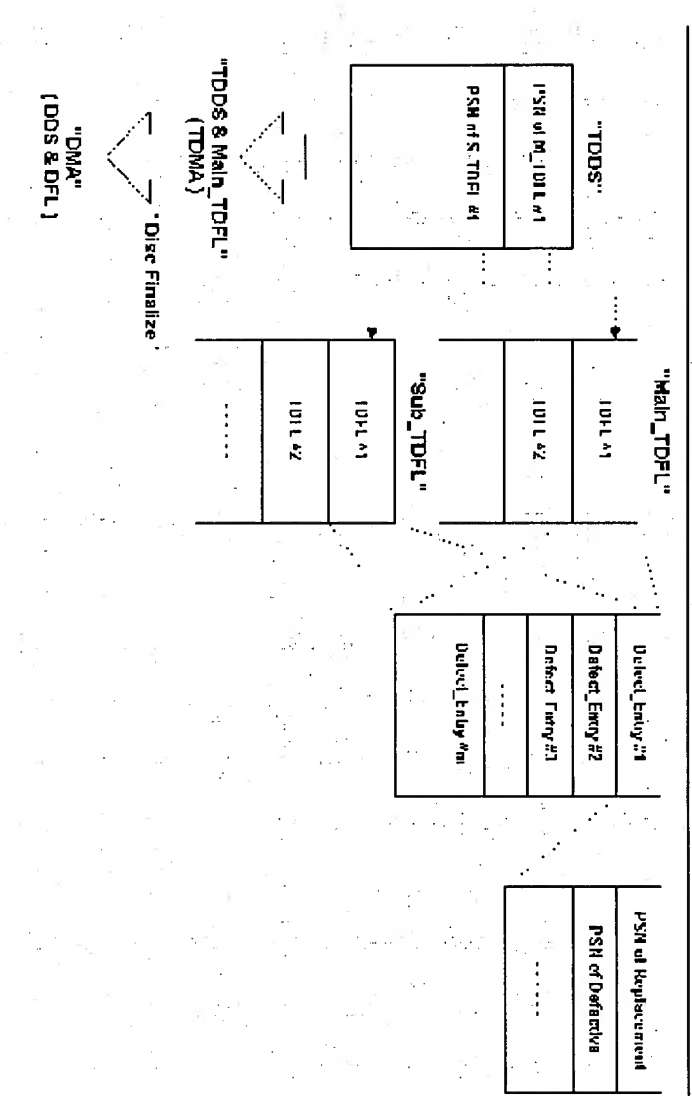


FIG. 4



Data Area		Data Area	
10A	Recording 1	Recording 2	TOTL ONE
10A	Recording 1	Recording 2	10A

"TMS & Data IDI"
(TMS)

"Sub_IDI"

"DMS & DEI"
(DMS)

FIG. 6

